AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

AMENDMENTS TO THE CLAIMS

1-63 (cancelled)

64. (currently amended) ~~Optical device, apt to generate and process optical codes at at least one wavelength,~~ An optical device, comprising:

P inputs s, with $1 \leq s \leq P$, and $P \geq 1$, and

N outputs k, with $1 \leq k \leq N$ and $N \geq 1$, ~~characterised in that it is apt~~ wherein the optical device is adapted to generate and process optical codes at at least one wavelength, the optical device is adapted to simultaneously generate and process N_C phase and/or amplitude optical codes at one or more wavelengths, with $N_C \geq 2$, made of C chips with time interval τ, with $C \geq 2$, ~~characterised in that the~~ wherein a transfer function $T_{sk}(f)$ from the input s to the output k satisfies the following formula:

$$\left|T_{sk}(f)\right| = \prod_{v=0}^{V-1}\left|F_v\left(a_v f + \frac{S_{sk}}{N_k \tau}\right)\right| \quad , \text{ for } \; s = 1,2..P \qquad k = 1,2,...N$$

where:

- $F_v(f)$ is a transfer function of an optical filter, for

$v = 0,1,\ldots,V-1$,

- a_v is a constant value, for $v = 0,1,\ldots,V-1$,
- S_{sk} is an integer number ($S_{sk} \in Z$),
- N_k is a constant value, for $k = 1,2,\ldots N$, and
- V is a positive integer number with $1 \le V \le \log_2 N$.

65. (currently amended) ~~Device~~ The device according to claim 64, ~~characterised in that~~ wherein the number C of chips of said optical codes is larger than or equal to the number N of outputs k:

$$C \ge N.$$

66. (currently amended) ~~Device~~ The device according to claim 64, , ~~characterised in that~~ wherein the number N_C of optical codes which it is apt to simultaneously generate and process is larger than or equal to the number N of outputs k:

$$N_C \ge N.$$

67. (currently amended) ~~Device~~ The device according to claim 64, , ~~characterised in that~~ wherein N_k is an integer constant value, for $k = 1,2,\ldots N$.

68. (currently amended) ~~Device~~ The device according to claim 64, ~~characterised in that~~ wherein the number P of inputs s

is equal to 1:

$$P = 1.$$

69. (currently amended) ~~Device~~ The device according to claim 64, ~~characterised in that it~~ wherein the device further comprises at least one tree having at least one node comprising a first coupler (21), including N_{IN} input waveguides and N_a output waveguides, with $N_{IN} \geq 1$ and $N_a \geq 1$, the outputs of which are connected to a grating (22) including N_a waveguides, which are in turn connected to N_a input waveguides of a second coupler (23), including N_{OUT} output waveguides, where $N_{OUT} \geq 1$.

70. (currently amended) ~~Device~~ The device according to claim 69, ~~characterised in that~~ wherein

$$\cancel{N_{IN} = N_a = N_{OUT} = N_{GRA}}$$

$$\underline{N_{IN} = N_a = N_{OUT}}.$$

71. (currently amended) ~~Device~~ The device according to claim 69, ~~characterised in that~~ wherein a constant optical phase shifter of value [[□j]] $\underline{\theta_j}$ is inserted along at least one of the waveguides j of the grating (22) with $j = 1,2,\ldots N_a$.

72. (currently amended) ~~Device~~ The device according to claim 69, ~~characterised in that~~ wherein the lengths L_j, with $j=1,2\ldots N_a$, of the waveguides of the grating (22), with $j=1,2\ldots N_a$,

are equal to ([18])

$$L_j = L_{m'} + d_j \Delta L \qquad j = 1,2,...N_a$$

with the integer number $d_j \in [0,1,2,...N_a - 1]$ satisfying the condition $d_k \neq d_{k'}$ if $k \neq k'$, where $L_{m'}$ is the length of a reference waveguide, equal to the shortest waveguide, whereby $d_{m'}$ = 0, and [[□*L*]] ΔL is the minimum difference between the lengths of two waveguides of the grating (22).

73. (currently amended) ~~Device~~ The device according to claim 72, ~~characterised in that~~ wherein ([33])

$$d_j = \left\{ \frac{1}{2}\left[(-1)^{j+m'}\left(j - \frac{1}{2}\right) - \left(m' - \frac{1}{2}\right) \right] \right\} \mathrm{mod} N_a \qquad m', j = 1,2,...N_a$$

where "*mod*" indicates the arithmetical module operator.

74. (currently amended) ~~Device~~ The device according to claim 69, ~~characterised in that~~ wherein d_j = $2j$. with j = 1,2…, N_a, where only the even inputs i (i = $2r$, for r =1,2,...,*int*[N_{IN}/2], where "*int*" indicates the arithmetical operator giving the integer quotient of a division) and the even outputs k (k = $2r'$, for r'=1,2,...,*int*[N_{OUT}/2]) are used.

75. (currently amended) ~~Device~~ The device according to claim [[6]] 69, ~~characterised in that~~ wherein the first coupler

is a uniform Multi Mode Interference or MMI coupler (21).

76. (currently amended) ~~Device~~ The device according to claim 69, ~~characterised in that~~ wherein the first coupler is a non uniform power splitter MMI coupler (21).

77. (currently amended) ~~Device~~ The device according to claim 75, ~~characterised in that~~ wherein the first MMI coupler (21) has a length

$$L_c = M_c 3 L_\pi / N_a,$$

where M_c is a positive integer number, and([13])

$$L_\pi = \frac{\pi}{\beta_0 - \beta_1} = \frac{4 n_g W_e^2}{3\lambda}$$

where

- ~~□$_0$ and □$_1$~~ β_0 and β_1 are propagation constants of the zeroth and first order modes, respectively,
- n_g is the effective refractive index,
- [[□]] λ is the free space wavelength of the input radiation, and
- W_e is the effective width of the fundamental transverse mode,

the device being further characterised in that, assuming that the first MMI coupler input waveguides are identified by an index i which increases according to a transverse direction and that the output waveguides are identified by an index j' which increases

according to said same transverse direction, the input waveguides i and the output waveguides j' are located, respectively, in positions x_i and $x_{j'}$ equal to ([14]):

$$x_i = (2i-1)\frac{W_e}{2N_{IN}} \qquad i = 1,2,\ldots N_{IN}$$
$$x_{j'} = (2j'-1)\frac{W_e}{2N_a} \qquad j' = 1,2\ldots N_a$$

78. (currently amended) ~~Device~~ The device according to claim 77, ~~characterised in that~~ wherein M_c and N_a are two positive integer numbers without a common divisor larger than 1.

79. (currently amended) ~~Device~~ The device according to claim 77, ~~characterised in that~~ wherein $M_c = 1$.

80. (currently amended) ~~Device~~ The device according to claim 69, ~~characterised in that~~ wherein the second coupler is a uniform MMI coupler (23).

81. (currently amended) ~~Device~~ The device according to claim 69, ~~characterised in that~~ wherein the second coupler is a non uniform power splitter MMI coupler (23).

82. (currently amended) ~~Device~~ The device according to claim 80, ~~characterised in that~~ wherein the second MMI coupler

(23) has a length

$$L'_c = M'_c 3 L'_\pi / N_{OUT},$$

where M'_c is a positive integer number and ([13])

$$L'_\pi = \frac{\pi}{\beta'_0 - \beta'_1} = \frac{4 n'_g W'^2_e}{3\lambda}$$

where

- ~~□'$_0$ and □'$_1$~~ β'_0 and β'_1 are propagation constants of the zeroth and first order modes, respectively,
- n'_g is the effective refractive index,
- [[□]] λ is the free space wavelength of the input radiation, and
- W'_e is the effective width of the fundamental transverse mode,

~~the device being further characterised in that~~ and, assuming that the second MMI coupler input waveguides are identified by an index j'' which increases according to a transverse direction and that the output waveguides are identified by an index k which increases according to said same transverse direction, the input waveguides j'' and the output waveguides k are located, respectively, in positions $x'_{j''}$ and x'_k equal to ([14]):

$$x'_{j''} = (2j''-1)\frac{W_e'}{2N_a} \qquad \text{for } j''=1,2,\ldots,N_a$$

$$x'_k = (2k-1)\frac{W_e'}{2N_{OUT}} \qquad \text{for } k=1,2,\ldots,N_{OUT}\ .$$

83. (currently amended) ~~Device~~ The device according to claim 82, ~~characterised in that~~ wherein M'_c and N_{OUT} are two positive integer numbers without a common divisor larger than 1.

84. (currently amended) ~~Device~~ The device according to claim 82, ~~characterised in that~~ wherein $M'_c = 1$.

85. (currently amended) ~~Device~~ The device according to claim 82, ~~characterised in that~~ wherein

$$\cancel{N_{IN} = N_a = N_{OUT} = N_{GRA}}$$

$$N_{IN} = N_a = N_{OUT},$$

a constant optical phase shifter of value [[□$_j$]] θ_j being inserted along at least one of the waveguides j of the grating (22) with $j = 1,2,\ldots N_a$, the first MMI coupler (21) having a length

$$L_C = M_C 3 L_\pi / N_a,$$

where M_c is a positive integer number, and([13])

$$L_\pi = \frac{\pi}{\beta_0 - \beta_1} = \frac{4 n_g W_e^2}{3\lambda}$$

where

- ~~□$_0$ and □$_1$~~ β_0 and $\beta_1$are propagation constants of the zeroth and first order modes, respectively,
- n_g is the effective refractive index,
- [[□]] λ is the free space wavelength of the input radiation, and

- W_e is the effective width of the fundamental transverse mode,

the device being further characterised in that, assuming that the first MMI coupler input waveguides are identified by an index i which increases according to a transverse direction and that the output waveguides are identified by an index j' which increases according to said same transverse direction, the input waveguides i and the output waveguides j' are located, respectively, in positions x_i and $x_{j'}$ equal to ([14]):

$$x_i = (2i-1)\frac{W_e}{2N_{IN}} \qquad i = 1,2,\ldots N_{IN}$$

$$x_{j'} = (2j'-1)\frac{W_e}{2N_a} \qquad j' = 1,2\ldots N_a$$

the values [[□j]] $\underline{\theta_j}$ of the phase shifters along the waveguides of the grating (22) being equal to ([20])

$$\varphi_{ij} + \varphi'_{jm} + \theta_j = 2\pi A_{ikm}$$

for $i = 1,2,\ldots,N_{IN} \quad j = 1,2,\ldots,N_a \quad m = 1,2,\ldots,N_{OUT} \quad k = 1,2,\ldots,N_{OUT}$

where ([15])

$$\varphi_{ij} = \phi_1 - \frac{\pi}{2}(-1)^{i+j+N_{GRA}} + \frac{\pi}{4N_{GRA}}\left[i + j - i^2 - j^2 + (-1)^{i+j+N_{GRA}}\left(2ij - i - j + \frac{1}{2}\right)\right]$$

with ([16])

$$\phi_1 = -\beta_0 \frac{3M_C L_\pi}{N_{GRA}} - \frac{9\pi}{8N_{GRA}} + \frac{3\pi}{4} \qquad ,$$

and ([20])

$$\varphi'_{jm} = \phi'_1 - \frac{\pi}{2}(-1)^{j+m+N_{GRA}} + \frac{\pi}{4N_{GRA}}\left[j + m - j^2 - m^2 + (-1)^{j+m+N_{GRA}}\left(2jm - j - m + \frac{1}{2}\right)\right]$$

with ([16])

$$\phi'_1 = -\beta'_0 \frac{3M'_C L'_\pi}{N_{GRA}} - \frac{9\pi}{8N_{GRA}} + \frac{3\pi}{4} \quad ,$$

where

A_{ikm} are integer constants.

86. (currently amended) ~~Device~~ The device according to claim 69, ~~characterised in that~~ wherein the absolute value of the transfer function $T_{ik}(f)$ from an input i of the first coupler to the output k of the second coupler is a frequency translated copy of the absolute value of the reference transfer function $T_{im}(f)$, from the input i of the first coupler (21) to an output m of the second coupler (23), so that ([24]):

$$|T_{ik}(f)| = \prod_{v=0}^{V-1}\left|F_v\left(a_v f + \frac{S_{ik}}{N_k \tau}\right)\right| = \left|T_{im}\left(f - n\frac{c}{n_e N_k \Delta L}\right)\right|$$

for $i = 1,2,\ldots, N_{IN} \quad k, m = 1,2,\ldots, N_{OUT}$

where:

- $F_0(f) = T_{im}(f)$,
- c is the light speed,
- $a_v = 1$,
- n_e is the refractive index of the waveguides of the grating (22),
- $V = 1$, and

- $S_{sk} = -n$, where n is an integer number satisfying the condition that the values corresponding to two different outputs k e k' are different ([25]):

$$k \neq k' \rightarrow n \neq n' \qquad k, k' = 1, 2, \ldots, N_{OUT}$$

whereby the time constant τ is equal to:

$$\tau = \frac{\Delta L \cdot n_e}{c} \quad .$$

87. (currently amended) ~~Device~~ The device according to claim 86, ~~characterised in that~~ wherein $N_k = N_{OUT}$ for $k=1,2,\ldots, N_{OUT}$.

88. (currently amended) ~~Device~~ The device according to claim 69, ~~characterised in that~~ wherein the first coupler is a focusing coupler or "slab".

89. (currently amended) ~~Device~~ The device according to claim 69, ~~characterised in that~~ wherein the second coupler is a focusing coupler or "slab".

90. (currently amended) ~~Device~~ The device according to claim 69, ~~characterised in that~~ wherein the first coupler is a focusing coupler or "slab", the second coupler is a focusing coupler or "slab", and the location of the input and output waveguides on the first coupler and on the second coupler is

based on the Rowland circle construction.

91. (currently amended) ~~Device~~ The device according to claim 88, ~~characterised in that~~ wherein the length of the adjacent waveguides in the grating varies by a constant [[□L]] ΔL.

92. (currently amended) ~~Device~~ The device according to claim 88, ~~characterised in that~~ wherein ([40]):

$$N_a = \frac{\lambda R}{n_s d d_o}$$

where:

- λ is the wavelength of the input optical signal,
- R is the focal length of the first and second focusing couplers,
- n_s is the effective refractive index of the first and second focusing couplers,
- d is the pitch of the waveguide grating, and
- d_o is the pitch of the N_{IN} input waveguides and the N_{OUT} output waveguides.

93. (currently amended) ~~Device~~ The device according to claim 88, ~~characterised in that~~ wherein, assuming that the N_{IN} input waveguides and the N_{OUT} output waveguides are identified,

respectively, by an index i and by an index k which increase according to the same transverse direction, the absolute value of the transfer function $T_{ik}(f)$ from an input i of the first coupler to the output k of the second coupler is a frequency translated copy of the absolute value of a reference transfer function $T_{im_{REF\_i}}(f)$, from the same input i to a corresponding reference output m_{REF_i}, with $1 \leq m_{REF\_i} \leq N_{OUT}$, so that ([44]):

$$\left|T_{ik}(f)\right| = \prod_{v=0}^{V-1}\left|F_v\left(a_v f + \frac{S_{ik}}{N_k \tau}\right)\right| = \left|T_{im_{REF\_i}}\left(f - \frac{i+k}{N_k \tau}\right)\right| \quad i = 1,2,\ldots,N_{IN} \qquad k = 1,2,\ldots,N_{OUT}$$

where:

- $F_0(f) = T_{im_{REF\_i}}(f)$,
- c is the light speed,
- $a_v = 1$,
- n_e is the refractive index of the waveguides of the grating (22),
- $V = 1$,
- $S_{sk} = (i + k)$, and
- the time constant τ is equal to:

$$\tau = \frac{\Delta L \cdot n_e}{c} \quad .$$

94. (currently amended) ~~Device~~ The device according to claim 93, ~~characterised in that~~ wherein

$$\cancel{N_{IN} = N_a = N_{OUT} = N_{GRA}}$$

$$\underline{N_{IN} = N_a = N_{OUT},}$$

and in that the index m_{REF_i} of the reference output waveguide corresponding to the input i is equal to:

$$m_{REF\_i} = \begin{cases} N_{GRA} - i & \text{for } i \neq N_{GRA} \\ N_{GRA} & \text{for } i = N_{GRA} \end{cases} \qquad i = 1,2,\ldots,N_{GRA}\,.$$

95. (currently amended) ~~Device~~ The device according to claim 93, ~~characterised in that~~ wherein $N_k = N_{OUT}$ for $k=1,2,\ldots,N_{OUT}$.

96. (currently amended): ~~Communication~~ A communication network, comprising:

one or more code generating devices (1), and

one or more code processing and recognising devices (4, 5),

~~characterised in that~~

wherein at least one of said one or more code generating devices (1) and/or at least one of said one or more code processing and recognising devices (4, 5) comprises at least one optical device (6)~~, apt~~ adapted to generate and process optical codes at at least one wavelength, comprising P inputs s, with $1 \leq s \leq P$, and $P \geq 1$, and N outputs k, with $1 \leq k \leq N$ and $N \geq 1$, ~~characterised in that it is apt~~ wherein the network is adapted to simultaneously generate and process N_C phase and/or amplitude optical codes at one or more wavelengths, with $N_C \geq 2$, made of C chips with time interval τ, with $C \geq 2$, ~~characterised in that the~~

and a transfer function $T_{sk}(f)$ from the input s to the output k satisfies the following formula:

$$|T_{sk}(f)| = \prod_{v=0}^{V-1} \left| F_v\left(a_v f + \frac{S_{sk}}{N_k \tau} \right) \right| \quad , \text{ for } s = 1,2..P \quad k = 1,2,...N$$

where:

- $F_v(f)$ is a transfer function of an optical filter, for $v = 0,1,...,V-1$,
- a_v is a constant value, for $v = 0,1,...,V-1$,
- S_{sk} is an integer number ($S_{sk} \in Z$),
- N_k is a constant value, for $k = 1,2,...N$, and
- V is a positive integer number with $1 \le V \le \log_2 N$.

97. (currently amended) ~~ommunication~~ The communication network according to claim 96, ~~characterised in that~~ wherein said at least one optical device (6) is included within at least one of said one or more code generating devices (1) for associating at least one optical code (2) to one or more information optical signals (3).

98. (currently amended) ~~Communication~~ The communication network according to claim 96, ~~characterised in that~~ wherein said at least one optical device (6) is included within at least one of said one or more code processing and recognising devices (4,

5) for controlling at least one optical switcher (13) on the basis of at least one recognised optical code (2).

99. (currently amended) ~~Communication~~ The communication network according to claim 98, ~~characterised in that~~ wherein said at least one of said one or more code processing and recognising devices (4, 5) within which said at least one optical device (6) is included is a router device.

100. (currently amended) ~~Communication~~ The communication network according to claim 96, ~~characterised in that it~~ wherein the communication network is a Multi Protocol Label Switching or MPLS communication network.

101. (currently amended) ~~Communication~~ The communication network according to claim 96, ~~characterised in that it~~ wherein the communication network is a Code Division Multiple Access or CDMA communication network.

102. (currently amended) ~~Code~~ A code generating device (1), ~~characterised in that it comprises~~ comprising:

an optical device (6)~~, apt~~ adapted to generate and process optical codes at at least one wavelength, comprising P inputs s, with $1 \le s \le P$, and $P \ge 1$, and N outputs k, with $1 \le k \le N$ and $N \ge 1$, ~~characterised in that it~~ wherein the device is [[apt]] adapted to

simultaneously generate and process N_C phase and/or amplitude optical codes at one or more wavelengths, with $N_C \geq 2$, made of C chips with time interval τ, with $C \geq 2$, characterised in that the transfer function $T_{sk}(f)$ from the input s to the output k satisfies the following formula:

$$|T_{sk}(f)| = \prod_{v=0}^{V-1} \left| F_v\left(a_v f + \frac{S_{sk}}{N_k \tau}\right) \right| \quad , \text{ for } s = 1,2..P \quad k = 1,2,...N$$

where:

- $F_v(f)$ is a transfer function of an optical filter, for $v = 0,1,...,V-1$,
- a_v is a constant value, for $v = 0,1,...,V-1$,
- S_{sk} is an integer number ($S_{sk} \in Z$),
- N_k is a constant value, for $k = 1,2,...N$, and
- V is a positive integer number with $1 \leq V \leq \log_2 N$,

the code generating device being apt to be used in a communication network comprising one or more code generating devices (1), and one or more code processing and recognising devices (4, 5).

103. (currently amended): ~~Code~~ A code processing and recognising device (4, 5), ~~characterised in that it comprises~~ comprising:

an optical device (6) configured for controlling at least

one optical switcher (13) on the basis of at least one recognised optical code (2), optical device (6) being [[apt]] adapted to generate and process optical codes at at least one wavelength, comprising P inputs s, with $1 \le s \le P$, and $P \ge 1$, and N outputs k, with $1 \le k \le N$ and $N \ge 1$, ~~characterised in that it is apt~~ wherein the device is adapted to simultaneously generate and process N_C phase and/or amplitude optical codes at one or more wavelengths, with $N_C \ge 2$, made of C chips with time interval τ, with $C \ge 2$, ~~characterised in that the~~ and a transfer function $T_{sk}(f)$ from the input s to the output k satisfies the following formula:

$$\left|T_{sk}(f)\right| = \prod_{v=0}^{V-1} \left| F_v\left(a_v f + \frac{S_{sk}}{N_k \tau}\right)\right| \quad , \text{ for } s = 1,2..P \quad k = 1,2,...N$$

where:

- $F_v(f)$ is a transfer function of an optical filter, for $v = 0,1,...,V-1$,
- a_v is a constant value, for $v = 0,1,...,V-1$,
- S_{sk} is an integer number ($S_{sk} \in Z$),
- N_k is a constant value, for $k = 1,2,...N$, and
- V is a positive integer number with $1 \le V \le \log_2 N$,

the code processing and recognising device (4, 5) being [[apt]] adapted to be used in a communication network comprising one or more code generating devices (1), and one or more code processing and recognising devices (4, 5).

104. (currently amended) ~~Code~~ The code processing and recognising device (4, 5) according to claim 103, ~~characterised in that it~~ wherein the device is a router device.